REMARKS/ARGUMENTS

Claims 1 to 20 are currently pending in the application. Claim 2 has been amended and claims 21 to 28 have been cancelled. No new matter has been added with the current amendment.

Rejections Under 35 USC §103 Over Peker, Suresh & Peker-Johnson

The Examiner rejected claims 1 to 8, 10 to 17, 19 and 20 under 35 U.S.C. §103(a) over Peker (USPN 5,866,254) in view of Suresh (Fundamental of Metal-Matrix Composites) and Peker-Johnson (USPN 5,288,344). Applicant respectfully traverses this rejection.

The current invention is directed to a method of forming fully-dense composites of Bulk-Solidifying Amorphous Alloy (BSAA) with a high-volume fraction of reinforcements. A particular objective of the invention is to achieve a high packing efficiency of the reinforcement wherein the volume fraction of those reinforcements is more than 50% by volume and preferably more than 75 % by volume of the overall composite. As discussed in the "Background" section of the application, even though composites with low-volume fraction reinforcement are produced rather readily, composites with "high-volume" fraction reinforcement are much more difficult to process and fabricate. (Specification, col. 1, ¶ 4.)

The current invention achieves this objective by purposefully "delaying" the shaping/forming process, and splitting the overall composite fabrication process into two steps, namely "densification" and "shaping/forming". (See, Specification, col. 1, ¶ 6.) Applicant has surprisingly found that this "splitting" and "delaying" of the shaping/forming process is crucial for making the high-volume reinforcement composites of BSAAs. Moreover, Applicant would submit that such a two-step process is simply not indicated by the teachings of the prior art. Indeed, splitting the process as described in the current application would tend to increase the overall cost of the

fabrication of the composites and has been avoided by the cited prior art methods. For example in direct contradiction to the teachings of the current invention, the Suresh publication, the only reference that actually describes a densification step at all, cites the use of single-step net-shape or near-shape process for composite fabrication. (Suresh, pg. 18, Section "Process Development", last paragraph.)

The use of a two-step process is crucial and surprising for two reasons. First, the BSAA needs to be cooled sufficiently fast to retain its amorphous structure and this causes significant complications in a single-step process. For example, as described in the Suresh reference the use of cold dies (to achieve the necessary cooling rates for BSAAs) causes major problems during infiltration of composites with high-volume fraction reinforcements. (Suresh, pg. 5, Section "1.1.1.4 Other Forces", 2nd paragraph.) Moreover, because higher forces must be used, a single-step method can result in the deformation and breakage of the reinforcement. Secondly, as specifically taught in the current invention, it has been surprisingly found that the relatively low melting temperatures and low reactivity of BSAAs makes it possible to re-heat the composite above the melting temperature without triggering reactions between the reinforcement and BSAA matrix. In contrast, the Suresh reference cites such chemical reaction problems as a motivation in teaching a single-step process that uses high force. (Suresh, pg. 5, Section "1.1.1.4 Other Forces", 2nd paragraph.) .

In addition, none of the prior art references teach the necessary information to allow one of skill in the art to arrive at the claimed two-step composite formation method. Specifically, the current invention teaches two separate approaches to achieving a two-step fabrication process. The first process requires reheating the densified composite above the first process temperature (densification temperature) for a period of less time than in the first step. The second alternative approach requires

reheating above the glass-transition of the BSAA (but below its crystallization temperature) and as such prefers BSAA alloys having a ΔT of more than 60 °C.

- For the first approach the Examiner alleges that the higher temperature and lesser time for the second step can be deduced from prior art. Applicant disagrees. Indeed, the example the Examiner cites in Peker teaches just the opposite. Specifically, example 1 in Peker teaches that one should heat the sample for less than one minute at 750 °C for the first step, while in the second step the sample is heated for two minutes at 900 °C. Accordingly, it is simply not true that by reading the Peker patent one of skill in the art would have been able to "deduce" the proposed two-step method of the current invention.
- For the second approach, there is simply no teaching in any of the cited prior art references for such a second forming/shaping step. Indeed, the only reference at all relevant is the Suresh reference, which teaches a single-step liquid-phase infiltration, again in direct contrast with the claimed methodology.

Accordingly, Applicant would submit that one of ordinary skill in the art, having read the combined disclosures of the Peker ('254), Suresh and Peker-Johnson ('344) references, simply would not have been provided the necessary details to create the two-step densification method claimed in the current application. Specifically, a densification process, whether single or multiple-step, is never described in either the Peker ('254) or Peker-Johnson patents, and the Suresh publication, while teaching a densification process, only teaches a single-step methodology. As such, Applicant would request reconsideration and withdrawal of this rejection.

Rejections Under 35 USC §103 Over Peker, Suresh & Szuecs

The Examiner also rejected claims 8 and 9 under 35 U.S.C. §103(a) over Peker (USPN 5,866,254) in view of Suresh (Fundamental of Metal-Matrix Composites) and Szuecs (Acta. Mater. (2001)). Applicant respectfully traverses this rejection for the

reasons cited above. Although Applicant acknowledges that the Szuecs publication does provide a teaching of a ductile phase BSAA, nowhere does the reference ever teach, describe or even suggest a two-step methodology for forming high-volume reinforcement composites of BSAAs as claimed herein.

Rejections Under 35 USC §103 Over Peker, Suresh, Peker-Johnson & Neil

The Examiner also rejected claim 18 under 35 U.S.C. §103(a) over Peker (USPN 5,866,254) in view of Suresh (Fundamental of Metal-Matrix Composites), Peker-Johnson (USPN 5,288,344) and Neil (USPN 4,952,353). Applicant respectfully traverses this rejection for the reasons stated above. Namely, although the Neil reference does describe a hot-isostatic process, nowhere does the reference ever teach, describe or even suggest using the process in combination with a two-step methodology for forming high-volume reinforcement composites of BSAA as claimed herein.

Conclusion

In conclusion, Applicant respectfully submits that the application should now be in condition for receipt of a Notice of Allowance.

Respectfully submitted,

KAUTH, POMEROY, PECK & BAILEY LLP

By ______________________
John W. Peck
Registration No. 44,284
949.852.0000

JWP/t